HEARING AID SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[01] The present application claims priority to United States Provisional Patent Application Number 60/445,034, filed February 5, 2003, United States Provisional Patent Application Number 60/514,994, filed October 27, 2003, and United States Provisional Patent Application Number 60/535,569, filed January 9, 2004, the entire contents of which are specifically incorporated herein by reference.

BACKGROUND

[02] A wide variety of hearing aid units are known in the art. Insertion of hearing aid receivers in the ear produces an insertion loss, which reflects a distortion or elimination of the patient's natural or original concha and ear canal resonant characteristics. The presently described hearing aid is configured to eliminate or significantly reduce such insertion losses.

[03] In some hearing aids, the receiver is also positioned within the ear canal in such a way that it creates an occlusion effect. In most cases, whether the hearing aid is fitted in the ear, as with a custom made instrument, or is placed behind the ear, an occlusion problem exists.

[04] This is often related to a patient's rejection of the amplification due to the patient's discomfort with the patient's own voice. That is, the occlusion effect is associated with the sensation or feeling that the patient's head is "at the bottom of the barrel," with the patient's own voice becoming intolerably loud.

[05] Placing an earmold or a shell of a custom made hearing aid within the ear canal can

produce a low frequency amplification of the patient's voice of between about 20 and 30 decibels. This can relate to a perceived loudness increase in the patient's own voice of about four times the actual loudness of the patient's voice.

[06] Accordingly, there remains a need in the art for an ear canal receiver that avoids the insertion loss and occlusion effect problems described above.

[07] One aspect of the present disclosure also relates to an improved system for treating tinnitus.

SUMMARY

[08] The above-discussed and other drawbacks and deficiencies of the prior art are overcome or alleviated by the presently described hearing aid system, including a receiver configured so as to create an insertion loss over the audible range of hearing below about three decibels as compared to the unaided ear.

[09] In another embodiment, a micro-receiver positioned in an open-ear configuration within the ear canal of a user, and a sound processing unit provided remote from the micro-receiver. The described hearing aid advantageously reduces the insertion and occlusion effects.

[10] In one exemplary embodiment, the receiver has a maximum lateral dimension ∅. Such dimension describes the maximum overall dimension or diameter (though it is not to be implied that the cross section of the receiver must be circular or oval) of the receiver. In one exemplary embodiment, the receiver has a dimension ∅ that is less than half the maximum lateral dimension or diameter of the user's ear canal. In another embodiment, the receiver has a dimension ∅ that is less than twenty percent of the maximum lateral dimension or diameter of the user's ear canal.

In another embodiment, the receiver has a dimension ∅ that is less than ten percent of the maximum lateral dimension or diameter of the user's ear canal. In another embodiment, the receiver has a dimension ∅ that is less than five percent of the maximum lateral dimension or diameter of the user's ear canal.

[11] In another exemplary embodiment, the hearing aid comprises a sound processing unit, a receiver, and an intermediate connecting portion between the sound processing unit and the receiver, wherein the intermediate connecting portion comprises an electrical conducting component and a stiffening wire, provided on at least a portion of the intermediate connecting portion. In another exemplary embodiment, the stiffening wire comprises a stainless steel wire. In another exemplary embodiment, the stiffening wire comprises a metal or alloy of metals having memory such that the wire may deflect and return to an original orientation. Such may be stainless steel, among others. Such may also be a shape memory alloy.

[12] In another exemplary embodiment, the stiffening wire is provided within or on a portion of the intermediate connecting portion and extends within or on at least a portion of the receiver. In such embodiment, the receiver is positioned on the intermediate connecting portion with greater stability and resiliency. Also where a stiffening element is used, the intermediate connecting portion and receiver may be custom manufactured or custom molded to optimize positioning of the receiver within the ear canal and/or to optimize positioning of the intermediate connecting portion.

[13] In another embodiment, a retaining wire extends from one of the stiffening wire and the receiver. The retaining wire is configured to position within a portion of the concha of the ear. In such embodiment, the retaining wire may be configured to prevent excessive insertion of the

hearing aid receiver into the ear canal. Also, the retaining wire may be configured to cause the hearing aid receiver to be suspended within a portion of the ear canal, such that no portion of the receiver touches the sides of the ear canal.

[14] In another embodiment, the electrical conducting component comprises two wires within distinct channels or otherwise isolated from one another within the intermediate connecting portion. In another embodiment, a stiffening element is provided within or on the intermediate connecting portion within a distinct channel or otherwise isolated from the wires.

[15] In another embodiment, the receiver comprises a speaker, at least partially enclosed within a casing having first and second end portions, the first end portion communicating with the intermediate connecting portion, the speaker communicating with a port provided at the second end portion of the casing. In another embodiment, the casing is sealed to fluids at the first end portion and along a length of the casing extending from the first end portion to the port provided at the second end portion. The port may also be sealed to fluids by a membrane or mesh material.

[16] The above-discussed and other features and advantages of the present invention will be appreciated and understood by those skilled in the art from the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[17] Referring now to the exemplary drawings wherein like elements are numbered alike in the several FIGURES:

[18] FIGURE 1 is a diagrammatic view of an exemplary receiver, intermediate connecting

portion and sound processing component connector for a hearing aid system;

[19] FIGURE 2 is a cross sectional view of an exemplary receiver and intermediate connecting portion;

[20] FIGURE 3 is an expanded plan view of an exemplary receiver, intermediate connecting portion and sound processing component connector for a hearing aid system;

[21] FIGURE 4 is a plan view of an exemplary assembled hearing aid system including a retaining wire;

[22] FIGURE 5 is a cutaway view of a user's ear with the hearing aid system installed;

[23] FIGURE 6 is a plan view of an exemplary sound processing unit; and

[24] FIGURE 7 is a plan view of another exemplary sound processing unit.

DETAILED DESCRIPTION

[25] Referring now to FIGURE 1, an exemplary receiver and connection portion is illustrated generally at 10 for the presently described hearing aid system. In one exemplary embodiment, the hearing aid system is configured as a completely open canal (COC) system. With reference to FIGURE 1, the illustrated exemplary receiver portion, shown generally at 12, includes a speaker 14 that is at least partially surrounded by a casing 16. The receiver portion 12 is attached to a connection portion, shown generally at 18, which includes an intermediate connecting portion 20 and a sound processing component connector 22. The sound processing unit connector 22 includes an electrical interface 24 configured to mate with a corresponding electrical interface (not illustrated) on the sound processing unit. The illustrated electrical interface 24 is a three-pin female interface, surrounded by a connector shell 26. While shell 26 is

illustrated as a two part shell joined by lock pin 28, it should be recognized that shell 26 may take any convenient configuration, or the interface 24 may simply comprise the electrical interface 24 such that the shell 26 is of minimal profile or is eliminated. Optionally, a microphone 27 may be provided in the shell 26. The microphone 27 may be connected to the sound-processing unit through an additional electrical connection (not shown) or through the electrical interface 24.

[26] Referring now to FIGURE 2, the exemplary receiver 12 and intermediate connecting portion 20 are illustrated in greater detail. The speaker 14 is illustrated as being at least partially enclosed within the casing 16. The illustrated exemplary intermediate connecting portion 20 comprises an electrical conducting component 30 and a stiffening wire 32, provided along at least a portion of the intermediate connecting portion 20. In another exemplary embodiment, the stiffening wire 32 comprises a stainless steel wire. In another exemplary embodiment, the stiffening wire 32 comprises a metal or alloy of metals having memory such that the wire may deflect and return to an original orientation. For example, the stiffening wire 32 may be a shape memory alloy.

[27] Referring again to FIGURE 2, the illustrated exemplary stiffening wire 32 is provided within or on a portion of the intermediate connecting portion 20 and extends within or on at least a portion of the receiver 12. The stiffening wire 32 in the illustrated exemplary embodiment extends through a channel 34 in the intermediate connecting portion 20, into a proximal portion 36 of the receiver 12 and alongside the speaker 14. In such embodiment, and indeed whenever the stiffening wire is used in or on any portion of the receiver 12 and the intermediate connecting portion 20, the receiver 12 may be positioned relative to the intermediate connecting portion 20

with greater stability and resiliency. Also where a stiffening wire 32 is used, the intermediate connecting portion 20 and receiver 12 may be custom manufactured or custom molded to optimize positioning of the receiver 12 within the ear canal and/or to optimize positioning of the intermediate connecting portion 20.

[28] Referring again to FIGURE 2, the illustrated electrical conducting component 30 is provided within a channel 38 within the intermediate connecting portion 20. The electrical conducting component 30 extends from the speaker 14 through the intermediate connecting component 20 to the electrical interface 24 to provide electrical connection between the sound processing unit and the speaker 14.

[29] With reference to FIGURE 3, in an exemplary embodiment, the electrical conducting component 30 comprises two wires 40, 42 provided within channel 38. While this embodiment illustrates both wires 40, 42 provided within the same channel 38, it is to be recognized that alternative configurations are contemplated. For example, both wires 40, 42 may share the same channel as the stiffening wire 32. Also, each wire 40, 42 may be provided within distinct channels or may be otherwise isolated from one another within the connection.

[30] Referring again to FIGURE 2, the illustrated exemplary receiver casing has first (proximal) 36 and second (distal) 44 end portions, the first end portion communicating with the intermediate connecting portion 20, the speaker 14 communicating with a port 46 provided at the second end portion 44 of the casing 16. As described by the illustrated exemplary embodiment, the casing is provided around the speaker from the intermediate connecting portion 20 to the port 46. Where non-permeable materials are used for the casing 16, the casing 16 is sealed to fluids at the first end portion 36 and along a length of the casing16 extending from the first end portion

36 to the port 46 provided at the second end portion 44. As illustrated, the port 46 may itself be sealed to fluids by a membrane or mesh material 48. The materials used for the casing may be formed in any number of manners, including as a two shell assembly, as an overmold, or as a shrinkwrap. Any material may be used. In one exemplary embodiment, the material is a polypropylene. In another embodiment, the material is a nylon or polyethylene. The port may also be provided with a permanent or removable cerumen collection device.

[31] Referring again to FIGURE 2, the receiver has a maximum lateral dimension ∅. Such dimension describes the maximum overall dimension or diameter (though it is not to be implied that the cross section of the receiver must be circular or oval) of the receiver 16. In one exemplary embodiment, the receiver has a dimension ∅ that is less than half the maximum lateral dimension or diameter of the user's ear canal. In another embodiment, the receiver has a dimension ∅ that is less than twenty percent of the maximum lateral dimension or diameter of the user's ear canal. In another embodiment, the receiver has a dimension ∅ that is less than ten percent of the maximum lateral dimension or diameter of the user s ear canal. In another embodiment, the receiver has a dimension ∅ that is less than five percent of the maximum lateral dimension or diameter of the user's ear canal.

[32] Referring now to FIGURE 4, a second exemplary hearing aid system is illustrated generally at 50. The receiver 16, intermediate connecting portion 20 and sound processing unit 52 are illustrated in assembled form. Sound processing component connector 22 is illustrated as joined with the sound processing unit 52. As illustrated, an exemplary retaining wire 54 extends from the receiver 16. As illustrated by FIGURE 5, the retaining wire 54 is configured to position within a portion of the concha 56 of the ear, shown generally at 58. In such embodiment, the

retaining wire 54 may be configured to define an exemplary maximum insertion of the hearing aid receiver 16 into the ear canal 60. For example, the configuration of the retaining wire 54, receiver 16 and intermediate connecting portion 20 may be such that the receiver extends into the ear canal, but not into the bony regions 62 of the ear canal 60. Also, as illustrated in FIGURE 5, the retaining wire 54 may be configured to cause the hearing aid receiver 16 to be suspended within a portion of the ear canal 60, such that no portion of the receiver touches the sides of the ear canal 60. While the retaining wire 54 is illustrated as extending from the receiver 16, it should be recognized that the retaining wire 54 may also or alternatively extend from the intermediate connecting portion 20.

[33] Referring now to FIGURE 6, an exemplary sound processing unit (SPU) is illustrated generally at 52. The illustrated SPU 52 generally includes: a housing 64; an SPU electrical interface 66, which is illustrated as a male three-pin electrical connection, connected to an amplifier and sound processing component 68; a microphone 70 connected to the amplifier and sound processing component 68; a battery component 72 providing power to the amplifier and sound processing component 68; a switch component 74, illustrated with a push button 76 for providing a user interface with the amplifier and sound processing component 68 and/or the battery component 72; and a programming connector 78 configured to permit external programming and reprogramming of the SPU and/or to permit expansion of the hearing aid device with additional internal components. A programming correction switch 79 may be provided to permit a physician or user to control programming or reprogramming of the amplifier and sound processing component 68. Additionally, an input port (not shown) may be provided proximate thereto (or indeed, anywhere on the device) to effect programming or

reprogramming of the device from an external source. Memory storage may be provided within the amplifier and sound processing component 68 and/or anywhere within the device to permit such programming and reprogramming of the SPU and/or to permit a user to select various programs via the user interface.

[34] FIGURE 7 illustrates a second exemplary SPU configuration, wherein the amplifier and sound processing component 68 is provided as a circuit board interconnecting each of the battery component 72, the switch component 74, the microphone 70 and the SPU electrical interface 66. In another exemplary embodiment, the behind the ear unit may comprise, or may additionally include, a noise generator, which may be used to generate one or more sounds. The sounds may be generated in specific frequency ranges useful to treat tinnitus. The noise generator passes such signals to the receiver for treatment.

[35] The following table summarizes statistical analysis of data collected in the comparison of four hearing devices (G = General Hearing Instruments, O = Oticon, S = Sebotek and V = Vivatone). The tested Vivatone Device was configured in accordance with the above described embodiment(s) including the micro-receiver and the retaining wire. The Vivatone Device also was positioned within the cartilaginous region of the ear in such a manner that the receiver did not contact the walls of the ear canal.

[36] The tested General Hearing Instruments was a canal-open-ear Auriscoe ™ hearing aid. The tested Oticon Device was a low profile, Open Ear Acoustics ™ configuration. The tested Sebotek Device was the PAC (Post Auricular Canal) hearing aid also described by U.S. Patent No. 5,606,621 to Reiter, the entire contents of which are specifically incorporated herein by reference.

[37] Thirty subjects participated in the evaluation. There were 120 runs, 4 for each participant. The data analyzed are the values of the Probe Real Ear Insertion Response Curve, which consisted of differences between the Probe Real Ear Unaided Response Curve and the Probe Real Ear Aided Response Curve and the corresponding values repeated while the subject vocalized the letter "EE". The two differences may be called the Insertion Effect and the Occlusion Effect. Values were given at 79 frequencies (200 Hz to 8000 Hz at increments of 100 Hz).

[38] Analysis of variance models were run for each frequency. Comparisons were adjusted for Subject variability, Order of Test, and Previous Device. The experimental error ranged over approximately 5-11 DB for the Insertion Effect and over approximately 3-8 DB for the Occlusion Effect.

[39] Comparison results are given in the following tables. Results are given for each frequency. T-values greater than 2.444 in absolute value are included in Table 1. T-values less than 2.444 values are not to be construed as statistically insignificant simply because thay are omitted from Table 1. Negative values indicate that the Insertion Effect or Occlusion Effect was greater for the Comparison Device compared to the Vivatone Device. Positive values indicate that the Insertion Effect or Occlusion Effect was greater for the Vivatone Device compared to the Comparison Device.

[40] The following table summarizes the comparisons at each frequency. Table values are positive or negative decibel differences. As may be seen from the tables, the Vivatone Device exhibits lower Insertion Effect across the range of frequencies as compared with the comparison devices. Indeed, it has been found that the Vivatone Device exhibits less than three decibels of

insertion loss across the audible spectrum. Also, with exception of the Oticon Device in the 500Hz to 1300Hz range, the Vivatone device exhibits lower Occlusion Effect across the range of frequencies as compared with the comparison devices.

TABLE 1. SUMMARY OF COMPARISONS

	Insertion Effect			Occlusion Effect		
	G vs. V	O vs. V	S vs. V	G vs. V	O vs. V	S vs. V
200 Hz			-28.99			-8.49
300			-30.56			-7.92
400			-31.14			-7.37
500			-31.32		+6.57	-7.76
600			-31.74		+9.21	-7.89
700			-32.60		+11.11	-8.40
800			-33.49		+11.64	-8.78
900			-34.11		+10.63	-8.82
1000			-34.83		+8.72	-9.08
1100			-34.78		+6.89	-9.96
1200			-34.56		+6.32	-10.39
1300		-7.51	-35.38		+5.32	-11.09
1400		-9.01	-36.61			-13.28
1500		-10.52	-37.15			-14.66
1600		-11.47	-37.44			-15.02
1700		-12.37	-37.60			-15.04
1800		-13.49	-37.72			-16.76
1900		-14.87	-38.18			-18.98
2000		-16.20	-38.48			-20.61
2100		-17.24	-38.52		-6.98	-22.09
2200	-6.88	-18.09	-38.29		-9.35	-23.23
2300	-7.70	-18.77	-38.02		-11.71	-24.65
2400	-8.49	-19.35	-37.57	-6.91	-14.08	-26.09
2500	-9.21	-19.82	-36.83	-7.89	-15.51	-26.73
2600	-9.67	-20.14	-35.83	-8.04	-15.52	-25.94
2700	-9.84	-20.29	-34.44	-7.61	-14.96	-24.63
2800	-9.86	-20.28	-33.03	-7.51	-14.66	-23.71
2900	-9.86	-20.15	-31.52	-7.54	-14.36	-23.26
3000	-9.79	-20.02	-30.26	-7.48	-14.06	-22.09
3100	-9.66	-19.90	-28.93	-7.06	-13.56	-20.71
3200	-9.51	-19.81	-27.73	-7.16	-13.49	-19.07

	Insertion Effect			Occlusion Effect		
	G vs. V	O vs. V	S vs. V	G vs. V	O vs. V	S vs. V
3300	-9.28	-19.66	-26.57	-7.31	-13.46	-17.75
3400	-9.07	-19.56	-25.57	-7.23	-13.07	-16.73
3500	-8.91	-19.45	-24.82	-7.37	-12.90	-15.77
3600	-8.69	-19.34	-24.16	-6.96	-12.01	-14.66
3700	-8.58	-19.31	-23.74	-6.53	-11.36	-13.51
3800	-8.44	-19.34	-23.46	-6.28	-10.75	-12.41
3900	-8.27	-19.37	-23.23	-6.05	-9.99	-11.55
4000	-8.09	-19.28	-23.03	-5.47	-9.21	-10.84
4100	-7.88	-19.27	-22.69	-5.23	-8.37	-10.11
4200	-7.65	-19.21	-22.26	-5.11	-7.56	-9.52
4300	-7.39	-19.18	-21.77	-4.90	-6.78	-8.75
4400	-7.15	-19.24	-21.18	-4.87	-6.07	-8.16
4500	-6.85	-19.34	-20.58	-4.95	-5.52	-7.89
4600	-6.54	-19.37	-19.95	-4.58	-4.86	-7.36
4700	-6.25	-19.49	-19.32	-4.28	-4.32	-6.82
4800	-5.95	-19.33	-18.65	-3.64	-3.69	-6.10
4900	-5.70	-19.10	-18.04	-3.01	-3.04	-5.42
5000	-5.42	-18.71	-17.37		-2.58	-4.73
5100	-5.13	-18.18	-16.68			-4.30
5200	-4.85	-17.48	-15.99			-3.74
5300	-4.64	-16.81	-15.43			-3.32
5400		-16.01	-14.83			-3.14
5500		-15.18	-14.40			-3.05
5600		-14.42	-14.20			-2.76
5700		-13.57	-14.19			-2.82
5800		-12.90	-14.30			-3.04
5900		-12.24	-14.66			-3.09
6000		-11.64	-15.01			-2.87
6100		-11.03	-15.24			-2.84
6200		-10.50	-15.60			-2.62
6300		-9.93	-15.85			
6400		-9.47	-16.12			
6500		-9.04	-16.43			-2.53
6600		-8.68	-16.76			-2.75
6700		-8.40	-17.02	-2.41		-2.93
6800		-8.14	-17.38	-2.50		-3.00
6900		-7.86	-17.57	-2.94		-3.20
7000	-5.37	-7.62	-17.64	-3.10		-3.04
7100	-5.98	-7.41	-17.93	-2.93		-2.85
7200	-6.54	-7.29	-18.20	-2.85		-2.98

	Insertion Effect			Occlusion Effect		
	G vs. V	O vs. V	S vs. V	G vs. V	O vs. V	S vs. V
7300	-6.76	-7.08	-18.29	-2.83		-3.10
7400	-6.83	-6.91	-18.37			-2.88
7500	-6.67	-6.68	-18.48			-2.78
7600	-6.45	-6.52	-18.43			-2.58
7700	-6.18	-6.29	-18.28			
7800	-6.06	-6.19	-18.22			
7900	-6.01	-6.17	-18.20			
8000	-5.99	-6.23	-18.25			

TABLE 2. RESULTS AT 200Hz

```
200 Hz

Insertion Effect

              Value  Std.Error      t.value
X1   -3.228805324  2.8128462   -1.147878383   (General vs. Vivatone)
X2   -3.973763109  2.6132138   -1.520642189   (Oticon vs. Vivatone)
X3  -28.990360956  2.6890912  -10.780728129   (Sebotek vs. Vivatone)

Occlusion Effect

            Value  Std.Error     t.value
X1   -1.76124202  2.3527289  -0.74859539
X2    3.03270998  2.1857518   1.38749056
X3   -8.48537631  2.2492174  -3.77259056
```

TABLE 3. RESULTS AT 300Hz

```
300 Hz

Insertion Effect

              Value  Std.Error      t.value
X1   -3.259075564  2.9386512   -1.109037917
X2   -3.984400433  2.7300902   -1.459439139
X3  -30.557774712  2.8093612  -10.877125620

Occlusion Effect

            Value  Std.Error     t.value
X1   -1.34258739  2.4706214  -0.54342093
X2    3.70308746  2.2952773   1.61335081
X3   -7.91842555  2.3619231  -3.35253321
```

TABLE 4. RESULTS AT 400Hz

400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.18071721	2.9913629	-1.06330036
X2	-3.71440204	2.7790608	-1.33656738
X3	-31.13784296	2.8597538	-10.88829507

Occlusion Effect

	Value	Std.Error	t.value
X1	-0.97685416	2.5694950	-0.3801736
X2	4.68242198	2.3871337	1.9615248
X3	-7.36959617	2.4564466	-3.00010500 Hz

TABLE 5. RESULTS AT 500Hz

500Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.06639030	3.0294176	-1.01220456
X2	-3.35011711	2.8144148	-1.19034237
X3	-31.31511356	2.8961342	-10.81272859

Occlusion Effect

	Value	Std.Error	t.value
X1	-0.42304814	2.5993905	-0.16274897
X2	6.57442272	2.4149074	2.72243260
X3	-7.76226106	2.4850268	-3.12361260

TABLE 6. RESULTS AT 600Hz

600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.8099533318	3.1302318	-0.897682188
X2	-2.9480594700	2.9080740	-1.013749811
X3	-31.7421838724	2.9925130	-10.607200022

Occlusion Effect

	Value	Std.Error	t.value
X1	1.04164510	2.4705285	0.4216284
X2	9.21450274	2.2951910	4.0146998
X3	-7.89446530	2.3618343	-3.3425145

TABLE 7. RESULTS AT 700Hz

700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.588272854	3.2245678	-0.80267279
X2	-2.847366146	2.9957148	-0.95047970
X3	-32.604172820	3.0826986	-10.57650368

Occlusion Effect

	Value	Std.Error	t.value
X1	1.889389684	2.2700032	0.83232909
X2	11.110529893	2.1088973	5.26840739
X3	-8.402816196	2.1701313	-3.87203123

TABLE 8. RESULTS AT 800Hz

800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.515782392	3.3207934	-0.757584738
X2	-3.398601005	3.0851111	-1.101613808
X3	-33.491112358	3.1746906	-10.549409992

Occlusion Effect

	Value	Std.Error	t.value
X1	1.82698457	2.2246681	0.8212392
X2	11.63631424	2.0667796	5.6301669
X3	-8.77668112	2.1267908	-4.1267252

TABLE 9. RESULTS AT 900Hz

900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.38554234	3.3949516	-0.70267345

	Value	Std.Error	t.value
X2	-4.09229805	3.1540062	-1.29749208
X3	-34.11309345	3.2455861	-10.51061120

Occlusion Effect

	Value	Std.Error	t.value
X1	1.92054270	2.1612333	0.88863274
X2	10.62901086	2.0078470	5.29373549
X3	-8.81972030	2.0661469	-4.26868009

TABLE 10. RESULTS AT 1000Hz

1000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.275590447	3.3148820	-0.686477055
X2	-4.883197416	3.0796193	-1.585649707
X3	-34.827767987	3.1690393	-10.990008326

Occlusion Effect

	Value	Std.Error	t.value
X1	1.90850033	2.0273877	0.94135935
X2	8.71736528	1.8835006	4.62827855
X3	-9.08163181	1.9381900	-4.68562518

TABLE 11. RESULTS AT 1100Hz

1100 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.156384500	3.2283746	-0.66794743
X2	-6.075641257	2.9992514	-2.02571923
X3	-34.777147774	3.0863378	-11.26809495

Occlusion Effect

	Value	Std.Error	t.value
X1	0.652209894	1.9516141	0.33418998
X2	6.892687975	1.8131048	3.80159378
X3	-9.956084782	1.8657502	-5.33623669

TABLE 12. RESULTS AT 1200Hz

1200 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-1.585101698	3.1910179	-0.496738573
X2	-6.880732089	2.9645460	-2.321006989
X3	-34.561124381	3.0506248	-11.329195525

Occlusion Effect

	Value	Std.Error	t.value
X1	0.1712529167	1.9293266	0.088763052
X2	6.3227648043	1.7923991	3.527543026
X3	-10.3896722765	1.8444433	-5.632958487

TABLE 13. RESULTS AT 1300Hz

1300 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-1.1981154661	3.1078549	-0.385512034
X2	-7.5105809960	2.8872852	-2.601260486
X3	-35.3762012491	2.9711206	-11.906686397

Occlusion Effect

	Value	Std.Error	t.value
X1	1.2358134856	1.8298857	0.675350090
X2	5.3236175161	1.7000157	3.131510866
X3	-11.0905638474	1.7493774	-6.339720527

TABLE 14. RESULTS AT 1400Hz

1400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-1.643093468	3.2026055	-0.51304897
X2	-9.006829511	2.9753112	-3.02718902
X3	-36.606739445	3.0617025	-11.95633446

Occlusion Effect

	Value	Std.Error	t.value
X1	1.218719994	1.7929210	0.67973995
X2	3.569212245	1.6656744	2.14280315
X3	-13.277066609	1.7140390	-7.74607050

TABLE 15. RESULTS AT 1500Hz

1500 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.004330563	3.3559284	-0.597250692
X2	-10.520911903	3.1177525	-3.374517947
X3	-37.149067713	3.2082798	-11.579123521

Occlusion Effect

	Value	Std.Error	t.value
X1	1.565644363	1.9150221	0.81755941
X2	3.037305910	1.7791098	1.70720543
X3	-14.661208291	1.8307681	-8.00822785

TABLE 16. RESULTS AT 1600Hz

1600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-1.951098286	3.2915707	-0.59275600
X2	-11.474827775	3.0579624	-3.75244240
X3	-37.443659502	3.1467536	-11.89913947

Occlusion Effect

	Value	Std.Error	t.value
X1	2.19998543	2.0883350	1.05346387
X2	2.69222085	1.9401223	1.38765520
X3	-15.01898313	1.9964558	-7.52282265

TABLE 17. RESULTS AT 1700Hz

1700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.09200068	3.1519854	-0.66370887
X2	-12.37275620	2.9282837	-4.22525864
X3	-37.59666754	3.0133095	-12.47686870

Occlusion Effect

	Value	Std.Error	t.value
X1	2.296444502	2.1572750	1.06451169
X2	2.044449766	2.0041696	1.02009817
X3	-15.035410954	2.0623628	-7.29038120

TABLE 18. RESULTS AT 1800Hz

1800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-2.7841781655	3.0546323	-0.911460998
X2	-13.4911317442	2.8378399	-4.754014423
X3	-37.7204275127	2.9202396	-12.916894941

Occlusion Effect

	Value	Std.Error	t.value
X1	1.299973079	2.2825012	0.56953884
X2	0.228669495	2.1205082	0.10783712
X3	-16.763530564	2.1820794	-7.68236495

TABLE 19. RESULTS AT 1900Hz

1900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.92267763	2.9833070	-1.31487560
X2	-14.86697694	2.7715767	-5.36408636
X3	-38.18257655	2.8520524	-13.38775431

Occlusion Effect

	Value	Std.Error	t.value
X1	-0.445001551	2.4921416	-0.17856191
X2	-2.149696858	2.3152701	-0.92848642
X3	-18.984168789	2.3824964	-7.96818358

TABLE 20. RESULTS AT 2000Hz

2000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.07137477	2.8884821	-1.755723078

X2	-16.19593588	2.6834817	-6.035418726
X3	-38.47923896	2.7613994	-13.934687726

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.85628537	2.4314096	-0.76346057
X2	-4.57822019	2.2588484	-2.02679391
X3	-20.60848494	2.3244365	-8.86601350

TABLE 21. RESULTS AT 2100Hz

2100 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.05449479	2.8084770	-2.15579289
X2	-17.24123089	2.6091547	-6.60797572
X3	-38.52172601	2.6849143	-14.34746975

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.98680095	2.4258921	-1.2312176
X2	-6.98416480	2.2537225	-3.0989462
X3	-22.09045009	2.3191617	-9.5251876

TABLE 22. RESULTS AT 2200Hz

2200 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.880641275	2.7399735	-2.51120723
X2	-18.094100656	2.5455130	-7.10823348
X3	-38.294583408	2.6194246	-14.61946370

Occlusion Effect

	Value	Std.Error	t.value
X1	-4.04732286	2.3505212	-1.72188312
X2	-9.35005881	2.1837008	-4.28174902
X3	-23.23487105	2.2471069	-10.33990481

TABLE 23. RESULTS AT 2300Hz

2300 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-7.702143365	2.7076991	-2.84453441
X2	-18.774332728	2.5155292	-7.46337303
X3	-38.024411656	2.5885702	-14.68934905

Occlusion Effect

	Value	Std.Error	t.value
X1	-5.220130253	2.2482925	-2.32181990
X2	-11.708355563	2.0887274	-5.60549718
X3	-24.646487441	2.1493758	-11.46681163

TABLE 24. RESULTS AT 2400Hz

2400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-8.486673413	2.6869395	-3.15849066
X2	-19.349755107	2.4962429	-7.75155131
X3	-37.572817183	2.5687240	-14.62703571

Occlusion Effect

	Value	Std.Error	t.value
X1	-6.906049894	2.1583519	-3.199686766
X2	-14.081049900	2.0051700	-7.022372074
X3	-26.086046643	2.0633922	-12.642311144

TABLE 25. RESULTS AT 2500Hz

2500 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.210748358	2.6528782	-3.471983194
X2	-19.817120519	2.4645989	-8.040708038
X3	-36.833570981	2.5361612	-14.523355801

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.8887912841	2.1296325	-3.704296963
X2	-15.5096824184	1.9784889	-7.839155515
X3	-26.7269510910	2.0359364	-13.127596011

TABLE 26. RESULTS AT 2600Hz

2600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.66555736	2.6025828	-3.71383279
X2	-20.13716999	2.4178731	-8.32846424
X3	-35.82550481	2.4880786	-14.39886359

Occlusion Effect

	Value	Std.Error	t.value
X1	-8.039373e+000	2.0445271	-3.9321428795
X2	-1.552271e+001	1.8994236	-8.1723244632
X3	-2.594425e+001	1.9545753	-13.2736008791

TABLE 27. RESULTS AT 2700Hz

2700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.8422402627	2.4996242	-3.937488045
X2	-20.2943035971	2.3222216	-8.739175965
X3	-34.4411171164	2.3896498	-14.412621118

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.613859887	1.9209320	-3.963627961
X2	-14.957610998	1.7846003	-8.381490995
X3	-24.625003741	1.8364180	-13.409258493

TABLE 28. RESULTS AT 2800Hz

2800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.86365196	2.3996114	-4.1105206
X2	-20.27641387	2.2293069	-9.0953891
X3	-33.03347336	2.2940372	-14.3997113

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.50588772	1.8590431	-4.0375006
X2	-14.65670749	1.7271037	-8.4862926
X3	-23.70698104	1.7772520	-13.3391220

TABLE 29. RESULTS AT 2900Hz

2900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.86079168	2.2699771	-4.34400497
X2	-20.15133560	2.1088730	-9.55549987
X3	-31.52307174	2.1701063	-14.52604933

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.543366871	1.8062716	-4.17620855
X2	-14.359771755	1.6780775	-8.55727583
X3	-23.256473650	1.7268022	-13.46794292

TABLE 30. RESULTS AT 3000Hz

3000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.7856477447	2.1508276	-4.549712685
X2	-20.0236465366	1.9981798	-10.020943400
X3	-30.2576796218	2.0561990	-14.715345668

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.47719814	1.74153648	-4.29344904
X2	-14.06177565	1.61793672	-8.69117777
X3	-22.09160667	1.66491522	-13.26890791

TABLE 31. RESULTS AT 3100Hz

3100 Hz

Insertion Effect

Value	Std.Error	t.value

	Value	Std.Error	t.value
X1	-9.664299909	2.0441730	-4.727730813
X2	-19.902779737	1.8990947	-10.480140962
X3	-28.927085690	1.9542369	-14.802241273

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.058142664	1.68138544	-4.197813587
X2	-13.560497213	1.56205470	-8.681192285
X3	-20.712909615	1.60741060	-12.885885895

TABLE 32. RESULTS AT 3200Hz

3200 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.510894160	1.9521516	-4.87200583
X2	-19.806347612	1.8136042	-10.92098708
X3	-27.726410309	1.8662641	-14.85663835

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.163145949	1.64523049	-4.353885967
X2	-13.488540806	1.52846573	-8.824889289
X3	-19.070659369	1.57284634	-12.124934858

TABLE 33. RESULTS AT 3300Hz

3300 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.2786068378	1.8838049	-4.925460512
X2	-19.6593344393	1.7501081	-11.233211221
X3	-26.5719530600	1.8009244	-14.754619026

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.31237040	1.66005982	-4.40488366
X2	-13.45522787	1.54224259	-8.72445614
X3	-17.74897246	1.58702323	-11.18381389

TABLE 34. RESULTS AT 3400Hz

3400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-9.066209111	1.8323300	-4.94791271
X2	-19.556815995	1.7022865	-11.48855723
X3	-25.574072634	1.7517142	-14.59945508

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.23388315	1.70948608	-4.2316128
X2	-13.07226920	1.58816098	-8.2310731
X3	-16.72753874	1.63427491	-10.2354498

TABLE 35. RESULTS AT 3500Hz

3500 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-8.91013789	1.7886133	-4.98158981
X2	-19.45460034	1.6616724	-11.70784323
X3	-24.81692370	1.7099208	-14.51349273

Occlusion Effect

	Value	Std.Error	t.value
X1	-7.3687376481	1.76527541	-4.174270831
X2	-12.8957066864	1.63999085	-7.863279640
X3	-15.7692838620	1.68760971	-9.344153291

TABLE 36. RESULTS AT 3600Hz

3600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-8.691367288	1.7763295	-4.89288013
X2	-19.342423503	1.6502604	-11.72083106
X3	-24.157524195	1.6981775	-14.22555931

Occlusion Effect

	Value	Std.Error	t.value
X1	-6.962227987	1.76558948	-3.94328809
X2	-12.008873432	1.64028264	-7.32122206
X3	-14.662004950	1.68790997	-8.68648519

TABLE 37. RESULTS AT 3700Hz

3700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-8.583079332	1.76270385	-4.86926908
X2	-19.313847560	1.63760180	-11.79398287
X3	-23.737175524	1.68515129	-14.08607978

Occlusion Effect

	Value	Std.Error	t.value
X1	-6.5337475500	1.74265157	-3.749313783
X2	-11.3626632173	1.61897267	-7.018440431
X3	-13.5120469265	1.66598124	-8.110563666

TABLE 38. RESULTS AT 3800Hz

3800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-8.441467426	1.75635543	-4.80624097
X2	-19.336107428	1.63170394	-11.85025478
X3	-23.463879959	1.67908218	-13.97422961

Occlusion Effect

	Value	Std.Error	t.value
X1	-6.278133968	1.68496687	-3.72596880
X2	-10.754862789	1.56538194	-6.87044005
X3	-12.412324737	1.61083445	-7.70552474

TABLE 39. RESULTS AT 3900Hz

3900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-8.270799727	1.76899901	-4.67541231
X2	-19.372231987	1.64345018	-11.78753833
X3	-23.226956475	1.69116949	-13.73425708

Occlusion Effect

	Value	Std.Error	t.value
X1	-6.04925683	1.66204356	-3.6396500
X2	-9.99092084	1.54408554	-6.4704452
X3	-11.55100361	1.58891969	-7.2697215

TABLE 40. RESULTS AT 4000Hz

4000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-8.086843450	1.72954953	-4.67569348
X2	-19.275861670	1.60680050	-11.99642501
X3	-23.027648032	1.65345564	-13.92698265

Occlusion Effect

	Value	Std.Error	t.value
X1	-5.468606286	1.53347467	-3.56615364
X2	-9.213260489	1.42464140	-6.46707337
X3	-10.842963904	1.46600737	-7.39625472

TABLE 41. RESULTS AT 4100Hz

4100 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-7.881860321	1.70361988	-4.62653695
X2	-19.265070702	1.58271112	-12.17219647
X3	-22.687028158	1.62866680	-13.92981556

Occlusion Effect

	Value	Std.Error	t.value
X1	-5.234017037	1.44847923	-3.613456733
X2	-8.367227067	1.34567823	-6.217851237
X3	-10.113523797	1.38475142	-7.303494094

TABLE 42. RESULTS AT 4200Hz

4200 Hz

Insertion Effect

Value	Std.Error	t.value

X1	-7.650776971	1.67932983	-4.55585129
X2	-19.207194367	1.56014498	-12.31115996
X3	-22.260182017	1.60544543	-13.86542428

Occlusion Effect

	Value	Std.Error	t.value
X1	-5.1074935588	1.37868912	-3.704601341
X2	-7.5586894898	1.28084124	-5.901347685
X3	-9.5194610061	1.31803181	-7.222481964

TABLE 43. RESULTS AT 4300Hz

4300 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-7.390373789	1.65707945	-4.45987897
X2	-19.182103586	1.53947374	-12.46016937
X3	-21.767082631	1.58417398	-13.74033587

Occlusion Effect

	Value	Std.Error	t.value
X1	-4.8960648158	1.30757620	-3.744382017
X2	-6.7790754700	1.21477533	-5.580517913
X3	-8.7460200811	1.25004761	-6.996549598

TABLE 44. RESULTS AT 4400Hz

4400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-7.146230694	1.63780680	-4.36329284
X2	-19.243600045	1.52156891	-12.64720903
X3	-21.178776976	1.56574926	-13.52628895

Occlusion Effect

	Value	Std.Error	t.value
X1	-4.87065603	1.25303258	-3.88709449
X2	-6.06657954	1.16410275	-5.21137805
X3	-8.16174608	1.19790370	-6.81335742

TABLE 45. RESULTS AT 4500Hz

4500 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.847453349	1.63031020	-4.20009231
X2	-19.340813305	1.51460436	-12.76954819
X3	-20.581624580	1.55858249	-13.20534829

Occlusion Effect

	Value	Std.Error	t.value
X1	-4.952060307	1.20193410	-4.12007640
X2	-5.516111259	1.11663082	-4.93995971
X3	-7.888428986	1.14905337	-6.86515456

TABLE 46. RESULTS AT 4600Hz

4600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.536781665	1.63166742	-4.00619732
X2	-19.370563786	1.51586525	-12.77855257
X3	-19.946411210	1.55987999	-12.78714471

Occlusion Effect

	Value	Std.Error	t.value
X1	-4.583931130	1.20319291	-3.80980565
X2	-4.866591929	1.11780029	-4.35372220
X3	-7.363325177	1.15025680	-6.40146201

TABLE 47. RESULTS AT 4700Hz

4700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.247439739	1.64057349	-3.80808282
X2	-19.485709545	1.52413924	-12.78473056
X3	-19.320813101	1.56839423	-12.31884990

Occlusion Effect

	Value	Std.Error	t.value
X1	-4.277111412	1.20635740	-3.54547616
X2	-4.319781388	1.12074019	-3.85440034
X3	-6.818258071	1.15328207	-5.91204726

TABLE 48. RESULTS AT 4800Hz

4800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.9496237669	1.65009622	-3.605622326
X2	-19.3341460166	1.53298612	-12.612081555
X3	-18.6504311493	1.57749799	-11.822792342

Occlusion Effect

	Value	Std.Error	t.value
X1	-3.63533451	1.19702245	-3.03698108
X2	-3.68529686	1.11206776	-3.31391396
X3	-6.10429061	1.14435781	-5.33424995

TABLE 49. RESULTS AT 4900Hz

4900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.69900795	1.67201132	-3.40847449
X2	-19.09922740	1.55334588	-12.29554066
X3	-18.04055946	1.59844891	-11.28629094

Occlusion Effect

	Value	Std.Error	t.value
X1	-3.007209843	1.15216066	-2.61006121
X2	-3.037454396	1.07038989	-2.83770842
X3	-5.416608544	1.10146978	-4.91761883

TABLE 50. RESULTS AT 5000Hz

5000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.42096921	1.69550964	-3.19725060
X2	-18.70751384	1.57517648	-11.87645583
X3	-17.36767314	1.62091338	-10.71474474

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.649642968	1.11875070	-2.36839447
X2	-2.583699149	1.03935109	-2.48587718
X3	-4.726811994	1.06952974	-4.41952366

TABLE 51. RESULTS AT 5100Hz

5100 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.12838471	1.72005712	-2.98152000
X2	-18.18322864	1.59798178	-11.37887104
X3	-16.68033428	1.64438087	-10.14383871

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.350640296	1.06203444	-2.21333717
X2	-2.222199512	0.98666007	-2.25224428
X3	-4.297318170	1.01530879	-4.23252337

TABLE 52. RESULTS AT 5200Hz

5200 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-4.846893396	1.73104035	-2.79998868
X2	-17.483734536	1.60818552	-10.87171496
X3	-15.991399029	1.65488088	-9.66317230

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.863905114	1.02038103	-1.82667559
X2	-1.588450835	0.94796287	-1.67564667
X3	-3.737920520	0.97548797	-3.83184685

TABLE 53. RESULTS AT 5300Hz

5300 Hz

Insertion Effect

	Value	Std.Error	t.value

X1	-4.635811384	1.74762530	-2.65263463
X2	-16.806580187	1.62359340	-10.35147110
X3	-15.434734844	1.67073615	-9.23828390

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.55178690	0.94658159	-1.6393588
X2	-1.11156094	0.87940111	-1.2639977
X3	-3.32312975	0.90493544	-3.6722285

TABLE 54. RESULTS AT 5400Hz

5400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-4.296048437	1.76786473	-2.430077577
X2	-16.007405575	1.64239640	-9.746371538
X3	-14.827069029	1.69008511	-8.772971794

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.357632686	0.92688227	-1.46473044
X2	-1.085022430	0.86109989	-1.26004247
X3	-3.141020167	0.88610283	-3.54475809

TABLE 55. RESULTS AT 5500Hz

5500 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-4.040537444	1.7891974	-2.258296111
X2	-15.177478550	1.6622150	-9.130875559
X3	-14.401720605	1.7104792	-8.419699405

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.172678260	0.90954444	-1.28930287
X2	-1.124977061	0.84499255	-1.33134554
X3	-3.053792404	0.86952779	-3.51201241

TABLE 56. RESULTS AT 5600Hz

5600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.842925160	1.8254446	-2.10519960
X2	-14.418027712	1.6958897	-8.50174849
X3	-14.202779253	1.7451316	-8.13851454

Occlusion Effect

	Value	Std.Error	t.value
X1	-0.949080983	0.92183414	-1.02955721
X2	-0.951847054	0.85641002	-1.11143848
X3	-2.755459070	0.88127679	-3.12666701

TABLE 57. RESULTS AT 5700Hz

5700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.696893582	1.8553649	-1.99254262
X2	-13.570943809	1.7236865	-7.87320879
X3	-14.186977436	1.7737356	-7.99836104

Occlusion Effect

	Value	Std.Error	t.value
X1	-0.981408120	0.94246447	-1.04132108
X2	-1.137744866	0.87557619	-1.29942417
X3	-2.818453141	0.90099947	-3.12814075

TABLE 58. RESULTS AT 5800Hz

5800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.485335327	1.9118784	-1.82299003
X2	-12.900093591	1.7761892	-7.26279241
X3	-14.302358724	1.8277627	-7.82506305

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.43215721	0.99833534	-1.4345452
X2	-1.30174219	0.92748180	-1.4035232
X3	-3.03832890	0.95441221	-3.1834556

TABLE 59. RESULTS AT 5900Hz

5900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.470882999	1.9551480	-1.77525331
X2	-12.237829059	1.8163879	-6.73745358
X3	-14.656469432	1.8691286	-7.84133809

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.570601603	1.01546928	-1.54667564
X2	-1.143278073	0.94339973	-1.21187026
X3	-3.089089793	0.97079233	-3.18202946

TABLE 60. RESULTS AT 6000Hz

6000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.505504506	1.9935030	-1.75846459
X2	-11.643669192	1.8520208	-6.28700782
X3	-15.008307749	1.9057962	-7.87508551

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.4782767934	1.03060693	-1.43437498
X2	-0.9518932129	0.95746303	-0.99418273
X3	-2.8687898427	0.98526398	-2.91169667

TABLE 61. RESULTS AT 6100Hz

6100 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.527926580	2.0085812	-1.75642715

X2	-11.026150510	1.8660288	-5.90888537
X3	-15.238089915	1.9202110	-7.93563327

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.581128817	1.06615246	-1.48302319
X2	-0.690258914	0.99048583	-0.69688924
X3	-2.842076531	1.01924563	-2.78841179

TABLE 62. RESULTS AT 6200Hz

6200 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.541042894	2.0249469	-1.748709011
X2	-10.499983894	1.8812330	-5.581437152
X3	-15.602866439	1.9358566	-8.059928816

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.560048975	1.10174868	-1.41597535
X2	-0.553851718	1.02355573	-0.54110558
X3	-2.615469069	1.05327575	-2.48317600

TABLE 63. RESULTS AT 6300Hz

6300 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.64729645	2.0274164	-1.79898731
X2	-9.92894474	1.8835273	-5.27146316
X3	-15.85389666	1.9382175	-8.17962727

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.38042349	1.09173705	-1.26442854
X2	-0.37261352	1.01425464	-0.36737669
X3	-2.33816761	1.04370459	-2.24025804

TABLE 64. RESULTS AT 6400Hz

6400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.72431243	2.0226028	-1.84134638
X2	-9.47118863	1.8790553	-5.04039902
X3	-16.11724147	1.9336157	-8.33528692

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.391813985	1.05689378	-1.31689107
X2	-0.267321456	0.98188426	-0.27225353
X3	-2.187831043	1.01039430	-2.16532401

TABLE 65. RESULTS AT 6500Hz

6500 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.713274489	2.0281956	-1.83082665
X2	-9.044965698	1.8842511	-4.80029737
X3	-16.426047721	1.9389623	-8.47156616

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.731417523	1.01416531	-1.707234029
X2	-0.548784418	0.94218829	-0.582457266
X3	-2.528227998	0.96954572	-2.607641843

TABLE 66. RESULTS AT 6600Hz

6600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-3.766690641	2.0267967	-1.85844519
X2	-8.678056381	1.8829516	-4.60875176
X3	-16.764044366	1.9376251	-8.65185156

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.98956391	0.95040501	-2.09338533
X2	-1.10722139	0.88295317	-1.25399786
X3	-2.75192688	0.90859065	-3.02878627

TABLE 67. RESULTS AT 6700Hz

6700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-4.014308937	2.0434736	-1.96445358
X2	-8.397504120	1.8984448	-4.42335962
X3	-17.021841498	1.9535682	-8.71320587

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.407488315	0.94010973	-2.5608588
X2	-1.341366154	0.87338857	-1.5358183
X3	-2.928638691	0.89874832	-3.2585749

TABLE 68. RESULTS AT 6800Hz

6800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-4.354917941	2.0694860	-2.10434760
X2	-8.141998692	1.9226111	-4.23486507
X3	-17.378004698	1.9784362	-8.78370757

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.500115515	0.98440958	-2.5397107
X2	-1.447595547	0.91454438	-1.5828598
X3	-2.996861320	0.94109914	-3.1844268

TABLE 69. RESULTS AT 6900Hz

6900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-4.748185680	2.1060634	-2.25453122
X2	-7.861928357	1.9565925	-4.01817352
X3	-17.572263041	2.0134043	-8.72763772

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.943078973	1.02579595	-2.8690686
X2	-1.751442140	0.95299349	-1.8378322
X3	-3.203777402	0.98066466	-3.2669449

TABLE 70. RESULTS AT 7000Hz

7000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.36964885	2.1060878	-2.54958453
X2	-7.62145160	1.9566152	-3.89522250
X3	-17.63774396	2.0134276	-8.76005873

Occlusion Effect

	Value	Std.Error	t.value
X1	-3.0958671835	1.09618801	-2.824211866
X2	-1.6347488389	1.01838971	-1.605229143
X3	-3.0436625264	1.04795973	-2.904369750

TABLE 71. RESULTS AT 7100Hz

7100 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.979052985	2.1484033	-2.78302176
X2	-7.409193538	1.9959275	-3.71215570
X3	-17.930145965	2.0538813	-8.72988412

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.93400085	1.12940070	-2.59783871
X2	-1.35279652	1.04924523	-1.28930442
X3	-2.84600351	1.07971117	-2.63589335

TABLE 72. RESULTS AT 7200Hz

7200 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.53523989	2.1790642	-2.9991039

X2	-7.29180932	2.0244124	-3.6019388
X3	-18.20102578	2.0831933	-8.7370797

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.854334671	1.13785077	-2.50853165
X2	-1.261150721	1.05709559	-1.19303375
X3	-2.983604193	1.08778948	-2.74281399

TABLE 73. RESULTS AT 7300Hz

7300 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.75636148	2.2050562	-3.06403143
X2	-7.08463282	2.0485597	-3.45834830
X3	-18.28648048	2.1080417	-8.67462921

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.82929369	1.10910247	-2.55097593
X2	-1.27314769	1.03038760	-1.23560075
X3	-3.10192981	1.06030599	-2.92550437

TABLE 74. RESULTS AT 7400Hz

7400 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.83076637	2.2407210	-3.04846800
X2	-6.91081533	2.0816933	-3.31980476
X3	-18.37488422	2.1421375	-8.57782685

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.49001160	1.07112286	-2.3246741
X2	-1.25209393	0.99510347	-1.2582550
X3	-2.88266037	1.02399735	-2.8151053

TABLE 75. RESULTS AT 7500Hz

7500 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.665475332	2.2928263	-2.90709996
X2	-6.678922730	2.1301006	-3.13549639
X3	-18.482033551	2.1919503	-8.43177578

Occlusion Effect

	Value	Std.Error	t.value
X1	-2.14003047	1.05586865	-2.0267961
X2	-1.06587090	0.98093188	-1.0865901
X3	-2.78648541	1.00941427	-2.7604973

TABLE 76. RESULTS AT 7600Hz

7600 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.453321221	2.3169883	-2.785219570
X2	-6.517903336	2.1525478	-3.027994735
X3	-18.428207086	2.2150493	-8.319547271

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.81049894	1.05228996	-1.7205324
X2	-0.71468545	0.97760718	-0.7310558
X3	-2.58402589	1.00599303	-2.5686320

TABLE 77. RESULTS AT 7700Hz

7700 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.176510870	2.3478779	-2.63067809
X2	-6.290253935	2.1812450	-2.88379060
X3	-18.283821601	2.2445798	-8.14576596

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.48510082	1.07347198	-1.3834556
X2	-0.55147183	0.99728587	-0.5529727
X3	-2.27496805	1.02624312	-2.2167925

TABLE 78. RESULTS AT 7800Hz

7800 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.06108309	2.3716242	-2.55566757
X2	-6.19084626	2.2033061	-2.80979857
X3	-18.21570774	2.2672814	-8.03416280

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.413226227	1.09382747	-1.29200104
X2	-0.491633275	1.01619670	-0.48379736
X3	-2.147169312	1.04570304	-2.05332607

TABLE 79. RESULTS AT 7900Hz

7900 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-6.01019067	2.3741523	-2.53151017
X2	-6.17081726	2.2056547	-2.79772587
X3	-18.20382232	2.2696982	-8.02037121

Occlusion Effect

	Value	Std.Error	t.value
X1	-1.116427464	1.12532100	-0.99209689
X2	-0.075233199	1.04545509	-0.07196215
X3	-2.042620033	1.07581097	-1.89867931

TABLE 80. RESULTS AT 8000Hz

8000 Hz

Insertion Effect

	Value	Std.Error	t.value
X1	-5.994943790	2.3595836	-2.540678681
X2	-6.231208076	2.1921200	-2.842548786
X3	-18.251784219	2.2557705	-8.091152906

Occlusion Effect

	Value	Std.Error	t.value
X1	-0.919289912	1.11313021	-0.82586018
X2	0.150751742	1.03412949	0.14577647
X3	-1.869693540	1.06415653	-1.75697229

[41] While exemplary embodiments have been shown and described, various modifications and substitutions may be made thereto without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustration and not limitation.

[42] What is claimed is: